Claims

[c1]

1. A tilted-beam illumination lens system, comprising:
a smooth upper surface; and
a lower surface comprising a plurality of deflective facets deployed asymmetrically about an axis tilted from the surface normal of said upper surface, said lower-surface facets receiving light from a common focal zone and forming a beam therefrom, said beam propagating upward within the body of said lens along said tilted axis, said beam exiting said upper surface with a net deflection angle relative to said surface normal of said smooth upper surface, said deflective facets comprising both refractive and totally internally reflecting facets.

[c2]

2. The system of Claim 1 wherein said deflection angle is 30°or more.

[c3]

3.The system of Claim 1 wherein positioned within said focal zone are one or more light-emitting diodes.

[c4]

4.The system of Claim 1 wherein said system is for use on a vehicle.

[c5]

5.The system of Claim 1 wherein said smooth upper surface has curvature conformal with that of the surface onto which said system is installed, and said deflective facets act to counter said curvature to produce substantially parallel rays exiting said upper surface.

[c6]

6.The system of Claim 1 wherein said deflective facets are linear grooves with transverse deflection, and said focal zone is a linear strip.

[c7]

7. The system of Claim 6 wherein said transverse deflection of said plurality of longitudinal facets is the same on both sides of said focal zone.

[c8]

8. The system of Claim 6 wherein said focal strip bears a multiplicity of point sources.

[c9]

9. The system of Claim 8 wherein said external surface comprises a plurality of transverse cylindrical lenses in correspondence with said point sources.

[c10]

10. The system of Claim 8 wherein each of said transverse cylindrical lenses comprises multiple radii of curvature.

[c11]

11. The system of Claim 1 wherein said deflective facets are circular grooves with a central focal zone and a tilted axis of rotational symmetry.

[c12]

12. The system of Claim 11 wherein said circular grooves comprise a TIR lens with rim angle greater than 90°, said tilted axis bringing said rim angle level with said focal zone.

[c13]

13. A tilted-beam illumination lens, comprising:
a smooth upper surface; and
a lower surface having a first half and a second half, wherein said first half is a converging TIR lens and said second half is a diverging TIR lens, said converging TIR lens and said diverging TIR lens having a plurality of deflective facets, each of said facets having the same output angle such that said first and second halves form a beam substantially off-axis relative to the surface normal of said smooth upper surface.

[c14]

14. The lens of Claim 13 wherein said deflection angle is 30° or more.

[c15]

15. The lens of Claim 13 wherein said lens is for use on a vehicle.

[c16]

16. The lens of Claim 13 wherein said smooth upper surface has a curvature conformal with that of the surface onto which said lens is installed.

[c17]

17. A tilted-beam illumination lens, comprising:
a smooth upper surface; and
a lower surface comprising a plurality of deflective facets having a bilaterally symmetric TIR lens profile wherein said TIR lens profile is titled relative to the surface normal of said smooth upper surface; and
a rim angle greater than 90° such that said lens forms a beam substantially off-axis relative to the surface normal of said smooth upper surface.

[c18]

18. The lens of Claim 17 wherein said deflection angle is 30° or more.

[c19]

19. The lens of Claim 17 wherein said lens is for use on a vehicle.

[c20]

20. The lens of Claim 17 wherein said smooth upper surface has a curvature conformal with that of the surface onto which said lens is installed.

[c21]

21. A method of redirecting radiant energy, comprising the steps of:
situating a lens on a body, wherein said lens has a smooth upper surface and a lower surface having a plurality of deflective facets, wherein said facets are both refractive and totally internally reflecting; and
deploying said plurality of deflective facets asymmetrically about an axis tilted from the surface normal of said upper surface; and
receiving light from a common focal zone; and
forming a beam of light from said lower surface; and
transmitting said beam of light with a net deflection angle relative to said surface normal of said smooth upper surface.

[c22]

22. The method of Claim 21 wherein said body is a vehicle.

[c23]

23. The method of Claim 21 wherein said deflection angle is 30° or more.

[c24]

24. The method of Claim 21 wherein said smooth upper surface has a curvature conformal with that of the surface onto which said lens is installed.